Amendments to the Claims

The text of all pending claims, along with their current status, is set forth below in accordance with 37 C.F.R. § 1.121.

[c1] (Original) A method for constructing a three-dimensional geologic model of a subsurface earth volume according to specific geological criteria, comprising the steps of:

(a) generating an initial frequency-passband model of the subsurface earth volume for at least one frequency passband;

(b) assigning values for at least one rock property in each initial frequency-passband model;

(c) combining the initial frequency-passband models to form an initial complete three-dimensional geologic model of the subsurface earth volume; and

(d) optimizing the initial complete three-dimensional geologic model by perturbing the rock property values in at least one of the models according to specified geological criteria.

[c2] (Original) The method of claim 1, wherein a tentative frequency-passband model is generated for at least one of a low-frequency passband, a mid-frequency passband, a high-frequency passband, and a full-frequency passband;

[c3] (Original) The method of claim 2, wherein a seismic-frequency passband represents the mid-frequency passband.

[c4] (Original) The method of claim 2, wherein an existing geologic model represents the full-frequency passband.

[c5] (Original) The method of claim 1, wherein the step of generating an initial model for a frequency passband comprises the steps of

(a) specifying an initial geologic architecture to define the limits of the model, the regions within the model, and stratigraphic correlations within the model; and

(b) creating a three-dimensional array of contiguous model blocks to represent all portions of the subsurface earth volume to be included within the model.

[c6] (Original) The method of claim 1, wherein the step of generating a initial model for a frequency passband comprises the steps of

(a) specifying an initial geologic architecture to define the limits of the model, the regions within the model, and stratigraphic correlations within the model; and

(b) creating a three-dimensional array of discrete model points to represent all portions of the subsurface earth volume to be included within the model.

[c7] (Original) The method of claim 1 wherein each rock property value is a measurable property of the subsurface volume selected from a group consisting of porosity, shale volume, net sand percent, net pore volume, hydrocarbon saturation, hydrocarbon pore volume, impedance, and permeability.

[c8] (Original) The method of claim 1, wherein a plurality of rock properties are assigned to each initial frequency-passband model.

[c9] (Original) The method of claim 1, wherein each assigned rock-property value is consistent with the frequency content of the corresponding initial frequency-passband model.

[c10] (Original) The method of claim 1, wherein the initial complete geologic model is formed from a single initial frequency-passband model.

[c11] (Original) The method of claim 1, wherein the initial complete geologic model is formed by summation of all initial frequency-passband models.

[c12] (Original) The method of claim 1, wherein the initial complete geologic model is formed by weighted summation of the initial frequency-passband models in the frequency domain.

[c13] (Original) The method of claim 1, wherein the step of optimizing the initial complete three-dimensional geologic model by perturbing the rock-property values comprises the steps of:

(a) specifying training criteria for at least one initial model, said training criteria being consistent with the frequency content of the corresponding model;

(b) calculating statistics that describe the characteristics of the assigned rock-property values in the at least one model;

(c) calculating the initial objective function;

(d) perturbing the rock-property values in the at least one initial model so that the rock-property values more closely correspond to the training criteria;

(e) calculating the objective function for the new tentative model;

(f) retaining the perturbed rock-property values and the new tentative objective function if the objective function is reduced;

(g) repeating steps (d) through (f) until the objective function is reduced to a specified limit; and

(h) outputting the final complete geologic model to file.

[c14] (Original) The method of claim 13, comprising the further step of:

(a) outputting each final frequency passband model to file.

[c15] (Original) The method of claim 13, wherein the subsurface earth volume includes more than one region and specified training criteria are unique for each region.

[c16] (Original) The method of claim 13, wherein the rock-property values in the initial complete geologic model are perturbed by simultaneously optimizing more than one initial model.

[c17] (Original) The method of claim 13, wherein the frequency content of each tentative model is maintained during perturbation of the rock-property values.

[c18] (Original) A method for constructing a three-dimensional geologic model of a subsurface earth volume according to specific geological criteria, comprising the steps of:

(a) specifying an initial geologic architecture to define the limits of the model, the regions within the model, and stratigraphic correlations within the model;

(b) creating a three-dimensional array of contiguous model blocks to represent all portions of the subsurface earth volume to be included within the model;

(c) assigning initial rock-property values to all model blocks in at least one initial frequency-passband model;

(d) combining the initial frequency-passband models to form an initial complete three-dimensional geologic model of said subsurface earth volume;

(e) specifying training criteria for the initial complete geologic model;

(f) calculating statistics that describe the characteristics of the assigned rock-property values in the complete geologic model;

(g) calculating the initial objective function;

(h) perturbing the rock-property values in the complete geologic model so that the rock-property values more closely correspond to the training criteria;

(i) calculating the objective function for the new tentative model;

(j) retaining the perturbed rock-property values and the new tentative objective function if the objective function is reduced;

(k) repeating steps (h) through (j) until the objective function is reduced to a specified limit; and

(l) outputting the final complete geologic model to file.

[c19] (Original) The method of claim 18; wherein each rock property value is a measurable property of the subsurface volume selected from a group consisting of porosity, shale volume, net sand percent, net pore volume, hydrocarbon saturation, hydrocarbon pore volume, impedance, and permeability.

[c20] (Original) The method of claim 18, wherein an assigned rock-property value is consistent with the frequency content of the corresponding initial frequency-passband model.

[c21] (Original) The method of claim 18, wherein the initial complete geologic model is formed from a single initial frequency-passband model.

[c22] (Original) The method of claim 18, wherein the initial complete geologic model is formed by summation of all initial frequency-passband models.

[c23] (Original) The method of claim 18, wherein the initial complete geologic model is formed by weighted summation of the initial frequency-passband models in the frequency domain.

[c24] (Original) The method of claim 18, wherein the step of perturbing the rock-property values comprises a series of sequential steps, wherein each step attempts to force a nearly perfect fit of the model statistics to one of the training criteria.

[c25] (Previously presented) The method of claim 24, wherein one of the steps includes replacing tentative rock-property values, in blocks intersected by the boreholes of wells, by corresponding values observed at each intersecting borehole segment.

[c26] (Original) The method of claim 24, wherein one of the steps includes replacing tentative rock-property values in all model blocks by resetting the tentative cumulative frequency distribution of a rock property to the desired cumulative frequency distribution of the property using a rank-transform method.

[c27] (Original) The method of claim 24, wherein one of the steps includes simultaneously perturbing rock property values in all blocks of the complete geologic model by replacing its tentative 3-D amplitude spectrum with a desired amplitude spectrum.

[c28] (Original) The method of claim 18, wherein at least one region is defined within the subsurface earth volume to be modeled and desired values for training criteria are unique for each region.

[c29] (Previously presented) The method of claim 18, further comprising the step of providing a suitably programmed digital computer to perform one or more of steps (a) through (l).